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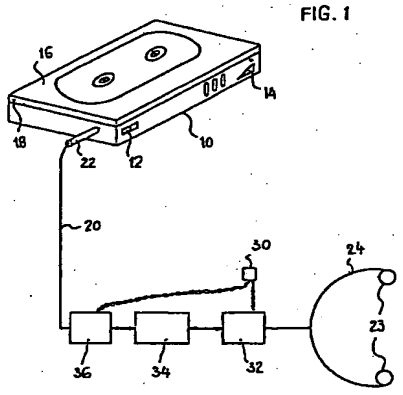
(54) Sound surge detector for alerting headphone users.

(57) For appliances or devices transmitting data originating from a sound source (10) and directed at headphones (23), the warning method provides for pick-up of external ambient signals followed by their processing in order to generate a control signal when an emergence of given minimum characteristics is detected, the said signal providing for activation of a warning signal and its transmission to the headphones (23).

FIG. 1



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Description

The present invention relates to an apparatus which monitors ambient sound level and, upon sensing the occurrence of a surge in sound, interrupts data transmission from a sound source to a receiver, More particularly, the invention relates to an electronic device which controls the attenuation level and/or generates a signal to interfere with the fidelity of sound reproduction emanating from a transmitter, for example, a cassette player, record player, or radio, and directed to a receiver, for example, a helmet or a pair of headphones.

In common use are many types of miniature portable appliances, such as cassette players, compact disc players, or credit card-sized radios, which through a helmet or a pair of headphones, allow the user to listen to favorite music or programs anywhere and at anytime. Such appliances have enjoyed great success for several years but they have the major disadvantage of acoustically isolating the user from the surrounding environment, particularly since a large number of users prefer to listen at a very high volume. Although perfect acoustic isolation allows for listening comfort, such isolation could subject the user to a wide range of accidents or risks.

Indeed, it is observed everyday and in every environment, such as in parks, on highways, or in sports grounds, that the majority of users of portable appliances are, by virtue of their helmets or headphones, completely insensitive to calls, warning signals, and, above all, to any sudden, unexpected change in their surroundings. This drawback could have such severe consequences that, in many locales, the use of such appliances with helmets or headphones is strictly forbidden to drivers of vehicles, pedestrians, and others who are required to be alert to their surroundings.

Furthermore, it is unpleasant, when calling someone nearby who is wearing a helmet or headphones, to have to shout in order to warn the person of some danger or simply to attract the person's attention.

Consequently, the use of such appliances in public places or places which are heavily frequented is not recommended because it renders the users insensitive to calls or communications of general or safety interests.

Several safety devices have been proposed in the past for making users or operators sensitive to the external noise.

The device disclosed in U.S. patent 3.158.835 simply detects, amplifies and transmits traffic noise to the operator of an enclosed vehicle.

Such a permanent transmission is totally unacceptable as it would bother the user of portable appliances.

Other devices, such as those disclosed in U.S. patents 4.088.836 and 4.475.230 and in the Japanese patents JP-A-58 190 107 and JP-A-59 11018 and also to same extend in WO-A-8 603 353 have been proposed to avoid the above mentioned drawback by providing circuits monitoring the level of the ambient noise and delivering either warning or command signals for discreasing the amplifying ratio or powering an alarm when the level of the monitored ambient noise exceeds a preset threshold for a given period of time.

Other devices, such as those disclosed in the Japanese patents JP-A-58 47 308 and JP-A-57 104 312 and in the German patent DE-A-30 46 862 are based on the detection of one or more frequencies or of a predetermined change in frequencies by means of electronic filters.

The device disclosed in WO-A-8 603 353 detects to some extend a source of informations by measuring the electric power consumption or by means of a logical electronic circuit.

As can be easily understood, such devices would also not be satisfactory as only reacting to a change of sound level. In fact, a bus, a car, an aircraft simply passing by; air conditioners, vacuum cleaners,... in operation, would make such devices operative while the noise or level of sound that they generate does not represent at all hazardous situations or abnormal events of which the user should be made aware.

The principal objective of the present invention is to remedy the aforesaid disadvantages by providing an apparatus by which the headphone user is alerted in a reliable manner upon the occurrence of a surge in sound representing an abnormal event or a warning of which the user should be made aware while minimizing false alerts in response to high sound levels that do not represent dangerous situations.

A second objective of the invention is to provide an inexpensive apparatus having a very small size which can be easily incorporated into miniature appliances or in the accompanying helmets or headphones or even partially in both.

Another object is to provide an apparatus with a built-in mechanism which generates a warning signal in an audible or visual form and maintains the signal for a predetermined period of time after it is generated.

A further object of the invention is to provide circuitry that accomplishes the predefined functions with minimum power consumption.

Those objectives and objects are met by using a method and an apparatus to perform that method according to the invention and having the characteristics described in claim 1.

Further objects and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawings and illustrating a prefered embodiment, in which :

Figure 1 is a perspective view of a portable appliance connected to headphones through circuit components shown in block diagram form;

Figures 2A and 2B represent schematically the electronic system components of the apparatus;

Figures 3A, 3B, 3C, and 3D represent

diagrams of the electrical signals appearing at different points in the electronic circuits shown in Figures 2A and 2B; and

Figures 4 and 5 represent alternative embodiments of warning devices.

Figure 1 shows a conventional portable cassette player 10 provided with a milled wheel 14 which volume can be regulated and a start-stop switch 12. A flap 16 pivoting about a spindle 18 makes it possible to insert or remove a magnetic tape cassette in the player 10. Connected to the player 10 via a lead 20 provided with a plug 22 are a pair of headphones 23 on a band or helmet 24. The cassette player 10 and headphones 23 are electronic system components currently available on the market which play and receive sound from recordings on a magnetic tape that are listened to by a user.

In accordance with the invention, electronic circuits are included in the lead 20 between the cassette player 10 and the headphones 23 which are operative when a user is listening through the headphones 23 and occur to generate a control signal which affects the transmission of sound to the headphones 23 and thereby alerts the user to an abnormal even or occurrence.

For this purpose and to carry out the invention, a microphone 30 is mounted at a location to receive sound from the surroundings. The microphone may be mounted on one of the components of the system, such as the helmet 24, one of the headphones 23, or the cassette player 10, as desired, as long as the location is adapted to pick-up sound from the surroundings. The microphone 30 transduces input ambient sound to an electrical signal which is fed to an amplifier 32, as illustrated in Figure 1, which, in turn, is connected to a signal processor 34 and a control signal generator 36.

With reference to Figure 2A, it can be seen in block diagram that in the amplifier 32 the amplification control is provided in the form of an adjustable potentiometer 42. The electrical signal obtained after amplification to enhance the signal-to-noise ratio can be measured at the point or node T1 in the form illustrated in Figure 3A.

The output signal from the amplifier which appears at the node T1 is supplied to the circuitry shown in Figure 2B which produces a control signal output only when a surge in sound occurs that represents an abnormal event, the circuitry being effective to filter or screen out surges in sound which are too brief or too gradual to represent an event about which the user should be alerted.

To accomplish this, as shown in Figure 2B, an envelope detector 43 detects the envelope of the amplified signal and produces a first output signal which can be measured at point T2 as shown in Figure 3B.

The first output signal is then processed by a differentiator 44, to obtain a second output signal measured at point T3 as shown in Figure 3C which is a "derivative" of the curve shown in Figure 3B and has an amplitude which is a function of the rate of change of the leading edge of the first output signal from the envelope detector 43.

The second output signal is then applied to the input of a comparator 45 which is calibrated to a preset threshold, so labeled in Figure 3C, the comparator 45 providing, at its output T4, a control signal, shown in Figure 3D, when the amplitude of the second output signal applied at its input exceeds the preset threshold value. The control signal is maintained for a duration determined by timer circuitry 46 in Figure 2B. A control signal is provided at the output terminal B shown in Figure 2B and is illustrated in Figure 3D.

Consequently, a control signal is delivered when a surge above the average ambient sound level is detected, the surge having predetermined minimum characteristics, such characteristics, including a minimum amplitude and duration and minimum slope of the rising leading edge of the surge-representing signal envelope. These minimum characteristics qualify a detected surge in sound as having been caused by an abnormal event about which a user of the system should be informed.

According to the invention, the rate at which the surge in sound is changing is a more accurate and reliable representation of an abnormal event than the amplitude of the surge alone.

Sensitivity of the system to surges in sound and the minimum characteristics of amplitude and duration of the surge-representing signal envelope that result in a control signal are set by the adjustable potentiometer 42 and by the RC time constants of the amplification, envelope detection, and differentiation circuits.

Two embodiments are illustrated which utilize the control signal to alert a user of the headphones 23 to an abnormal event. In the first embodiment, shown schematically in Figure 4, two transistors 50, 51 one for each audio channel between the cassette player 10 and the headphones 23, are supplied with the control signal appearing at the output terminal B in Figure 2B. The transistors 50, 51 are operated to attenuate or cut-off the audio signal transmitted from the player 10 to the headphones 23 so that the user becomes aware of the surrounding conditions for a predetermined length of time.

Alternatively, the control signal received from the terminal B may be utilized to activate a pulse or frequency generator, in place of the transistors 50, 51, the output from which is superimposed on the audio signal transmitted to the headphones 23 in such a manner as to warn or alert the user, the warning signal being maintained for a predetermined length of time.

In another alternative embodiment illustrated schematically in Figure 5, the microphone 30 is connected through a circuit to the headphones 23 so that, responsive to a surge in sound, the output from the cassette player 10 is disconnected and the microphone output is directly connected to the headphones so that the user hears the ambient sound from the surroundings. For this purpose, as shown in Figure 5, the control signal from the terminal B in Figure 2B is utilized to operate a switching circuit 55 which disconnects the L and R audio channels from the cassette player 10 to the headphones 23 and connects into the same two channels the output of the microphone 30.

These alternative embodiments discussed above may be combined in a single system.

Other alternatives of warning signals for alerting users may be used, such as modulated signals or interruption of the reproduction mode, without departing from the invention.

With regard to the construction of the circuitry and the location of the component parts, a wide range of alternative exists. As previously noted, the microphone may be associated with the appliance, such as the cassette player, or with the helmet (24) or one of the headphones (23). In the case of portable appliances provided with recording means, it is possible to use the microphone incorporated into the appliance and provided to pick up signals to be recorded in order to detect surges in sound in relation to the ambient sound level after the ampliance is switched from the recording to the playback mode. To provide a most compact apparatus, the circuitry may be constructed entirely in integrated circuit form instead of in discrete circuits and components as shown.

The disclosed apparatus enables the user to listen to the ambient surroundings by generating an alert or control message, a process which is far simpler and faster than searching for the volume control of the player and turning down the sound volume and then restoring it to its original level, as is customary with existing appliances.

As will be appreciated, such an apparatus, with its simple and inexpensive construction, considerably enhances the safety of using helmets or headphones without hampering the user in any way. It ensures that the user is warned of any occurrence producing a surge in sound satisfying certain set criteria, as previously noted.

Claims

1. Warning method for a device transmitting data emanating from a sound source (10) and directed at headphone (23), characterised in that the signals from the ambient surroundings are picked up, amplified, their amplitude and slope measured to obtain a representation of emergences, the result of this measurement being compared with a given reference in order to retain only the emergences of minimum characteristics, a control signal is generated when an emergence of minimum characteristics is detected.

2. A method according to claim 1, characterised in that the control signal is generated for a predetermined length of time.

3. A method according to either of the preceding Claims, characterised in that the control signal assures attenuation of the signal emanating from the sound source (10).

4. A method according to any one of the preceding Claims, characterised in that the control signal assures the generation of audible warning pulses or frequencies.

5. A method according to any one of the preceding Claims, characterised in that the control signal ensures transmission to the headphones (23) of the signals picked up by the audio pick-up and representing the ambient surroundings.

6. A method according to any one of the preceding Claims, characterised in that the minimum characteristics which emergences must satisfy in order to be retained can be modified.

7. A device for carrying out the method according to any one of the preceding Claims, characterised in that it comprises an audio pick-up (30) connected to an amplification circuit (32), the output signal from which is applied to a circuit delivering a control signal (36) when an emergence of minimum characteristics in relation to the ambient surroundings is detected.

8. A device according to Claim 7, characterised in that the control signal generated upon detection of an emergence of minimum characteristics is applied to a delay or time-lag circuit (46), maintaining the said control signal for a predetermined period of time.

9. A device according to Claims 7 and 8, characterised in that the detection of the emergence is carried out by obtaining the envelope of the signal produced at the output of the amplifier (32) then the derivative of this signal.

10. A device according to the preceding Claim, characterised in that the "derivative" signal obtained is compared with a reference threshold in order to generate a control signal when it is greater than the said threshold.

11. A device according to Claims 7 and 10, characterised in that the control signal is applied to the terminals of components for attenuating the transmission of signal from the audio source (10) to the helmet or headphone (23).

12. A device according to Claims 7 and 10, characterised in that the control signal is applied to the terminals of a logic circuit for transmitting to the headphones (23) the signal representative of the surrounding environment.

13. A device according to Claims 7 and 10, characterised in that the control signal is applied to the terminals of a device for generating pulses or frequencies, ensuring their transmission to the headphones (23).

14. A device according to any one of Claims 7-13 and applied to an appliance having a recording function, characterised in that the microphone which permits recording is used as an audio pick-up (10) when in the playback mode.

15. A device according to any one of Claims 7 to 14, characterised in that the audio pick-up is situated in proximity of the helmet (24) or headphones (23).

16. A device according to any one of Claims 7-15, characterised in that it comprises a

regulating means (42) for adjusting the characteristics which the emergences have to satisfy in order to be retained and generate the control signal.

FIG. 1

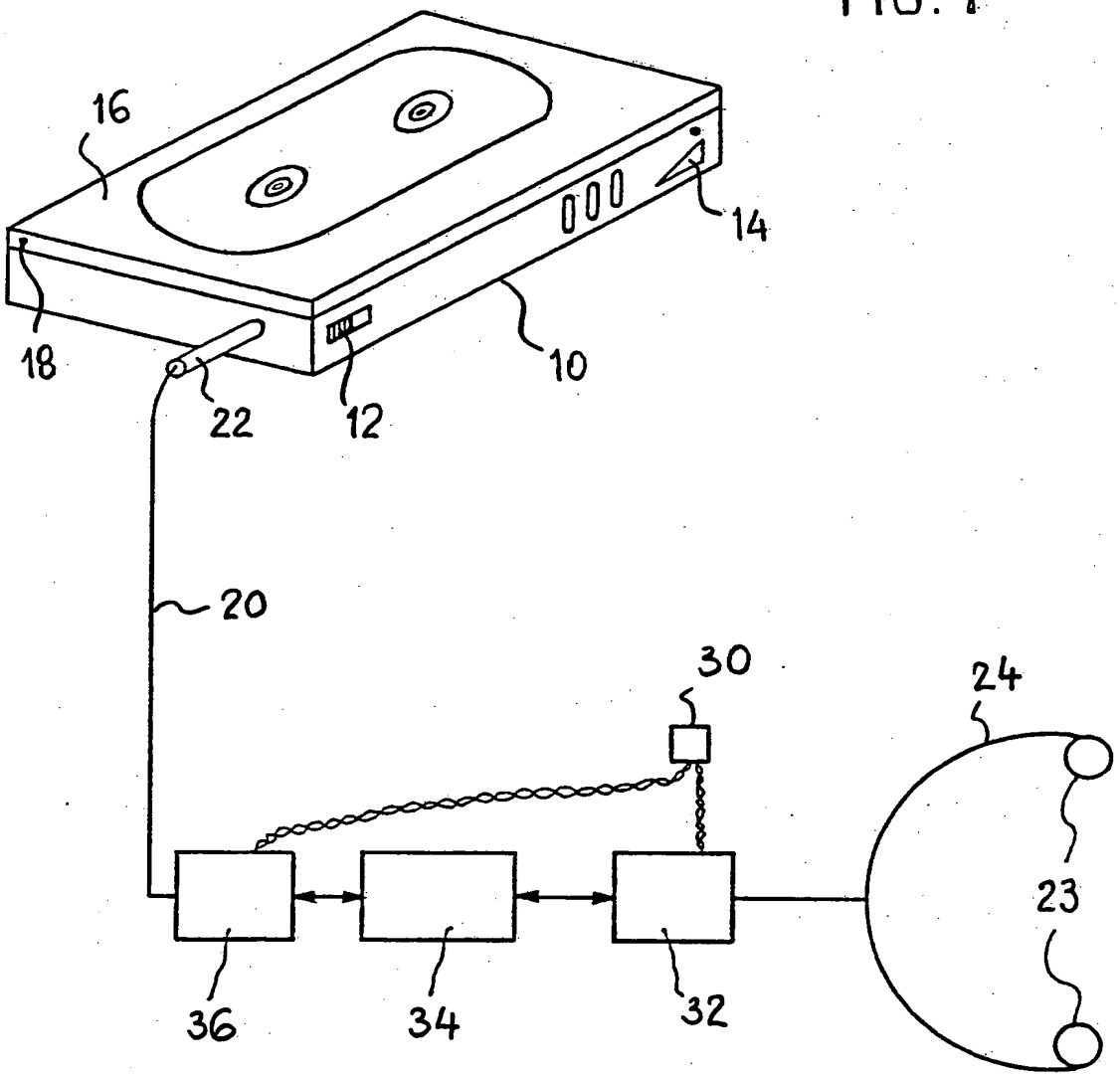


FIG. 2A

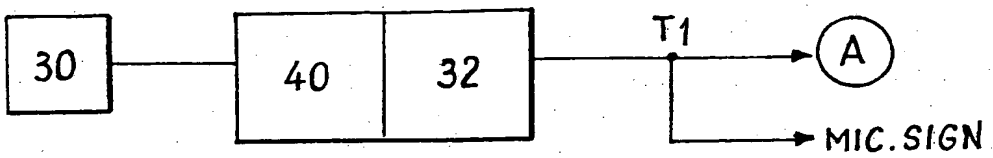


FIG. 2B

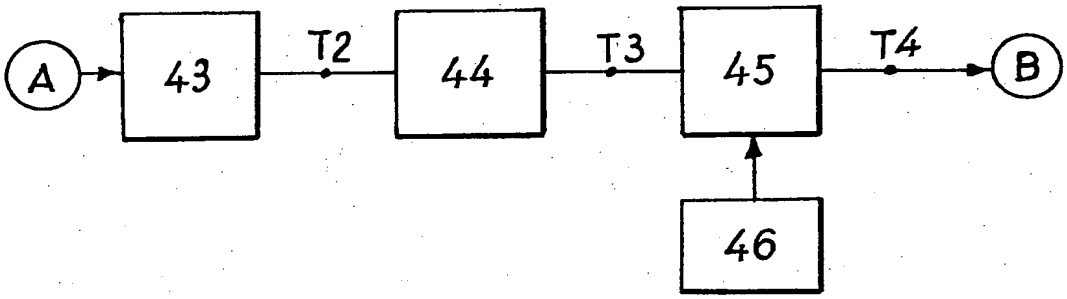


FIG. 4

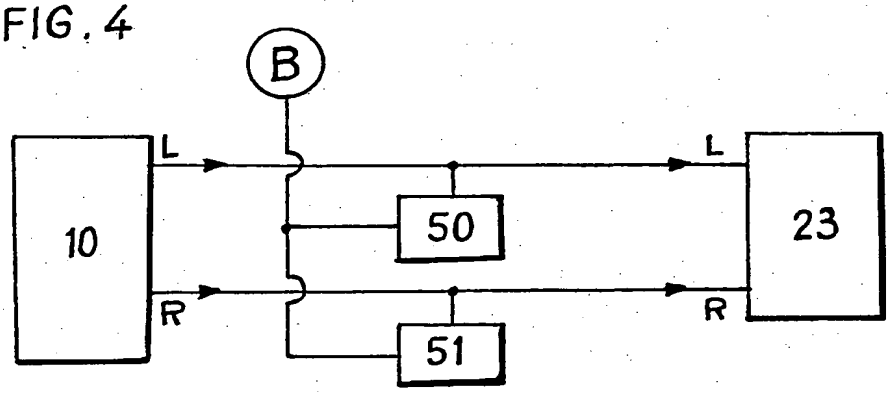


FIG 3A

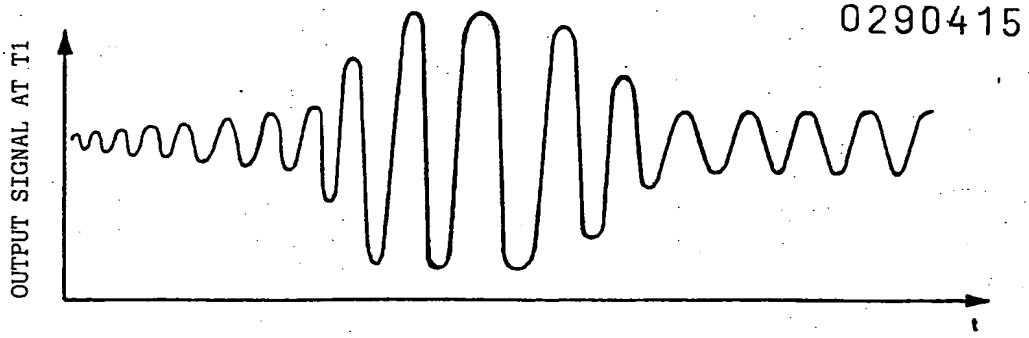


FIG 3B

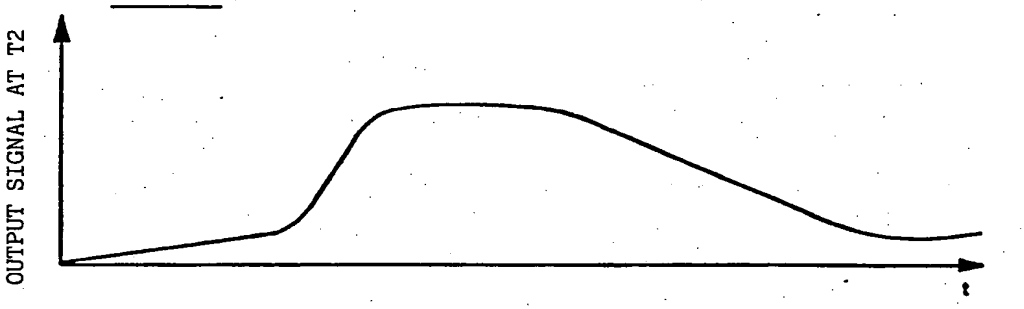


FIG 3C

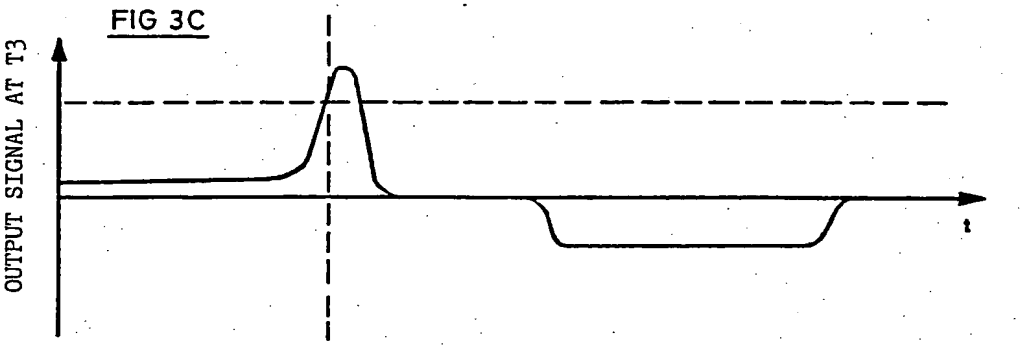


FIG 3D

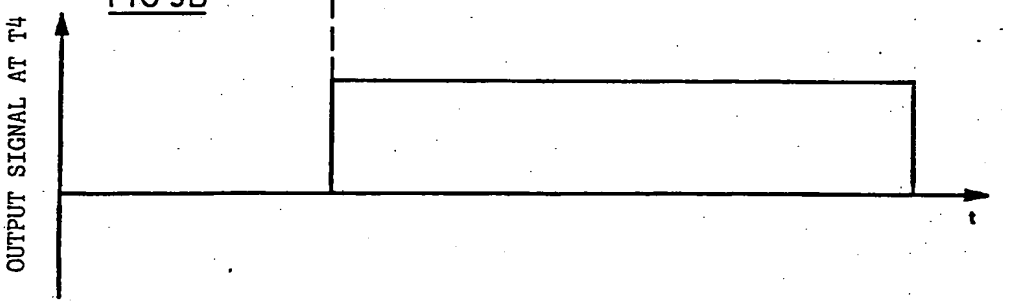
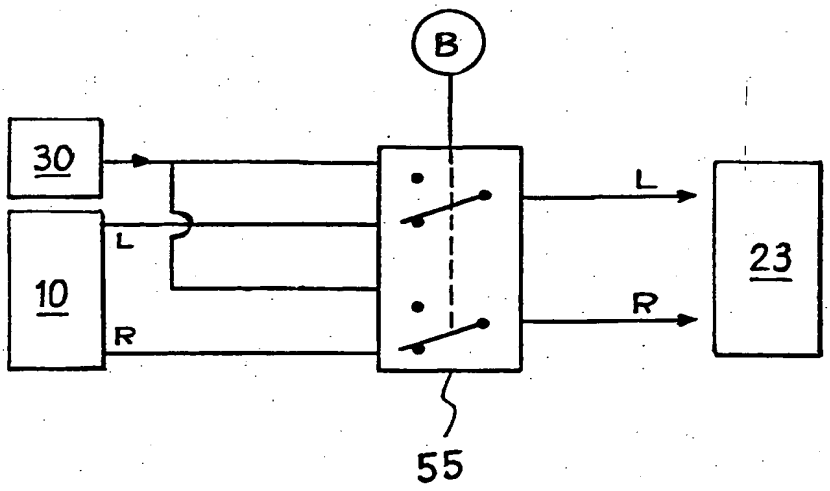


FIG.5



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EUROPEAN SEARCH REPORT

Application Number

EP 88 87 0065

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	PATENT ABSTRACTS OF JAPAN, vol. 8, no. 29 (E-226)[1466], 7th February 1984, page 45 E 226; & JP-A-58 190 107 (TOKYO SHIBAURA DENKI K.K.) 07-11-1983 * Abstract * ---	1,3,5,7,11,12,15	G 08 B 3/10 H 03 G 3/22
X	PATENT ABSTRACTS OF JAPAN, vol. 8, no. 91 2 (E-241)[1528], 26th April 1984, page 97 E 241; & JP-A-59 11 018 (PIONEER K.K.) 20-01-1984 * Abstract * ---	1,3,5,7	
X	PATENT ABSTRACTS OF JAPAN, vol. 7, no. 132 (E-180)[1277], 9th June 1983, page 45 E 180; & JP-A-58 47 308 (ARUPAIN K.K.) 19-03-1983 * Abstract * ---	1	
X	PATENT ABSTRACTS OF JAPAN, vol. 6, no. 194 (E-134)[1072], 2nd October 1982, page 23 E 134; & JP-A-57 104 312 (SONY K.K.) 29-06-1982 * Abstract * ---	1	
X	WO-A-8 603 353 (WARRACK) * Abstract * ---	1	TECHNICAL FIELDS SEARCHED (Int. Cl.4) G 08 B H 03 G
X	DE-A-3 046 862 (JÄGER) * Whole document * -----	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16-08-1988	SGURA S.

CATEGORY OF CITED DOCUMENTS

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